

4500V POWER MOSFETs

Ideal for very high voltage power conversion applications

JULY 2013

OVERVIEW

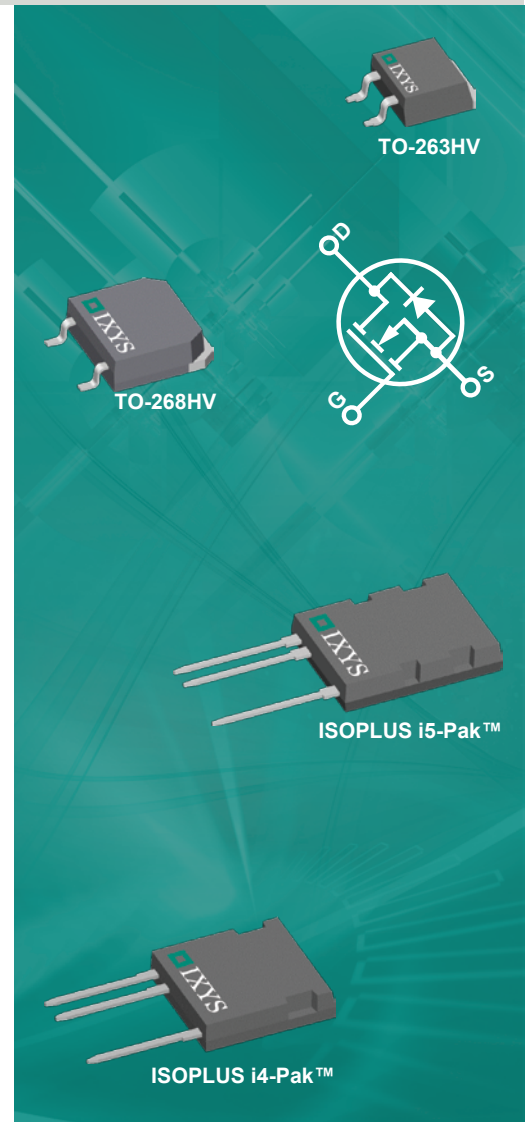
IXYS Corporation (NASDAQ: IXYS), a manufacturer of power semiconductors and integrated circuits for energy efficiency, power management, and motor control applications, announces the release of the highest voltage Power MOSFET product line in the industry – 4500V N-Channel Power MOSFETs in international standard size packages. The current ratings range from 200mA to 2A. They are specifically designed to address demanding, fast-switching power conversion applications requiring very high blocking voltages up to 4.5kV.

Thanks to the positive temperature coefficient of their on-state resistance, these very high voltage MOSFETs are ideally suited for parallel device operation, which provides cost-effective solutions compared to series-connected, lower-voltage MOSFET ones. This also results in reduction in the associated gate drive circuitry, further simplifying the design, saving PCB board space, and improving the reliability of the overall system.

Moreover, a ceramic isolation of up to 4.5kV is achieved with the Direct Copper Bond (DCB) substrate technology – an electrically isolated tab is provided for heat sinking. The DCB provides low thermal impedance and best-in-class power and temperature cycling capabilities. And the molding epoxies meet the UL 94 V-0 flammability classification.

These new Power MOSFETs can provide an optimal solution for applications such as capacitor discharge circuits, high-voltage automated test equipment, laser and x-ray generation systems, high-voltage power supplies, and pulse circuits.

The 4500V Power MOSFETs are available in IXYS' proprietary high-voltage versions of the international standard packages: TO-263HV, TO-268HV, ISOPLUS i4-Pak™, ISOPLUS i5-Pak™. The part numbers include IXTT02N450HV, IXTA02N450HV, IXTF02N450, IXTF1N450, IXTT1N450HV, IXTL2N450, with collector current ratings of 200mA, 200mA, 200mA, 900mA, 1A, and 2A, respectively.



FEATURES

- High blocking voltage
- Proprietary high voltage ISOPLUS™ packages
- Up to 4500V electrical isolation (DCB)
- UL 94 V-0 Flammability qualified (molding epoxies)

ADVANTAGES

- High power density
- Space savings (eliminates multiple series-connected devices)
- Easy mounting

APPLICATIONS

- Capacitor discharge circuits
- High voltage power supplies
- Pulse circuits
- Laser and X-ray generation systems
- High voltage relay disconnect circuits
- Energy tapping applications from the power grid

4500V Power MOSFETs Summary Table

| Part Number | V _{DSS} (V) | I _{D(cont)} TC = 25°C (A) | R _{DS(on)} max. T _J =25°C (Ω) | C _{iss} typ. (pF) | Q _g typ. (nC) | t _r typ. (μs) | R _{th(jc)} max. (°C/W) | P _D (W) | Package Type |
|--------------|-------------------------|--|---|-------------------------------|-----------------------------|-----------------------------|------------------------------------|-----------------------|-----------------|
| IXTA02N450HV | 4500 | 0.2 | 750 | 256 | 10.4 | 1.6 | 1.1 | 113 | TO-263HV |
| IXTF02N450 | 4500 | 0.2 | 750 | 256 | 10.4 | 1.6 | 1.6 | 78 | ISOPLUS i4-Pak™ |
| IXTT02N450HV | 4500 | 0.2 | 750 | 256 | 10.4 | 1.6 | 1.1 | 113 | TO-268HV |
| IXTF1N450 | 4500 | 0.9 | 85 | 1730 | 40 | 1.75 | 0.77 | 165 | ISOPLUS i4-Pak™ |
| IXTT1N450HV | 4500 | 1 | 85 | 1730 | 40 | 1.75 | 0.24 | 520 | TO-268HV |
| IXTL2N450 | 4500 | 2 | 23 | 6900 | 156 | 1.75 | 0.56 | 220 | ISOPLUS i5-Pak™ |

Competitive Landscape

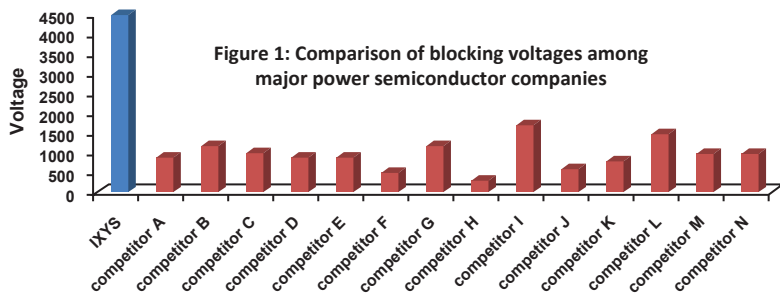
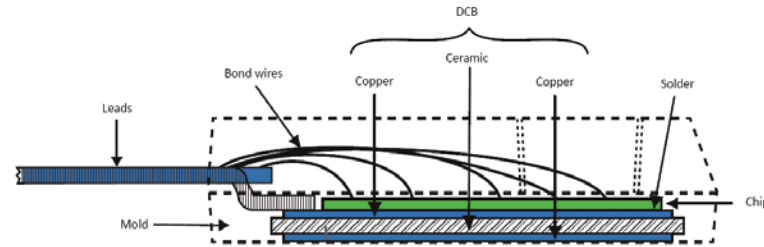


Figure 1 clearly shows the dominance of IXYS when it comes to very high voltage discrete Power MOSFETs. There are very few, if any, competitors above 1700V.

Direct Copper Bond (DCB) isolation



- Provides up to 4500V ceramic isolation
- Improves temperature and power cycling capabilities
- Reduces EMI/RFI due to low coupling capacitance between die and heat sink
- Lowers thermal resistance ($R_{th(jc)}$)
- Allows new circuit configurations

Application Circuits

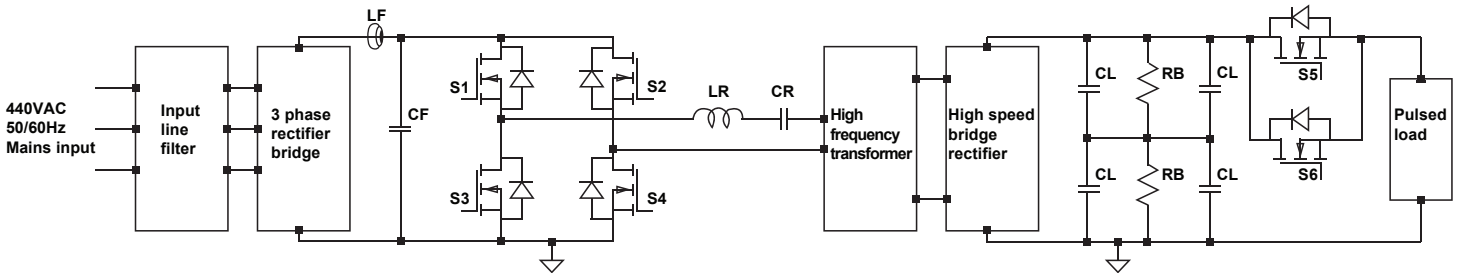


Figure 2: Capacitor-charging power supply circuit

Figure 2 depicts a general capacitor-charging power supply used in pulsed power applications. The AC mains input is first conditioned via an input line filter and then rectified by a three-phase rectifier bridge. The rectified power enters a DC choke filter before reaching an electrolytic capacitor used for filtering the DC power bus. It is further processed by a resonant H-bridge inverter which consists of four 4500V Power MOSFETs, **IXTT1N450HV** (S1,S2,S3,S4), before it is stepped up via a high frequency transformer. The output of the transformer enters a high speed bridge rectifier designed to charge the series-parallel capacitor combination. Two 4500V devices, **IXTT1N450HV** (S5, S6), in parallel control the output to the pulsed load.

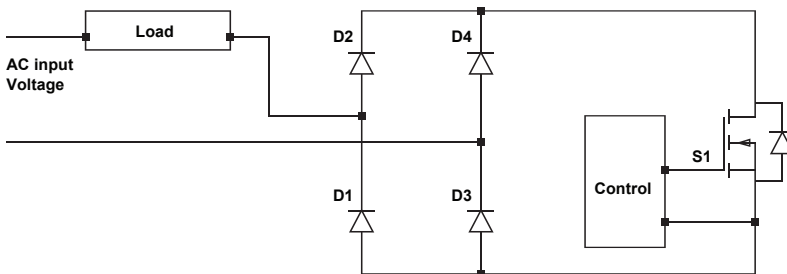


Figure 3: AC switch

Figure 3 illustrates an AC switch circuit that employs a 4500V Power MOSFET, **IXTL2N450** (S1). It is a cost effective option. It can control the current precisely and also provide an over-current protection function.